

Furthermore, in each instance, the AP—MgO adsorbed substantially more acetaldehyde than did the activated carbon.

#### EXAMPLE 8

An experiment was conducted to determine the ability of powder AP—MgO to adsorb organic species other than acetaldehyde. This ability was compared to the adsorptive ability of three commercially available samples of activated carbon. The molar ratio of adsorbent to propionaldehyde was 10:1. The adsorption conditions and procedures followed were as described in Example 4 except that gaseous propionaldehyde was recirculated over and through the adsorbents under atmospheric pressure of air for about 20 hours. As set forth in FIG. 5, the AP—MgO adsorbed more propionaldehyde than any of the activated carbon samples. As shown in Example 4, pelletized AP—MgO will achieve substantially the same results.

#### EXAMPLE 9

An experiment was conducted to determine the ability of powder AP—MgO to adsorb dimethylamine compared with the ability of activated carbon to adsorb dimethylamine. The molar ratio of adsorbent to dimethylamine was 10:1. The adsorption conditions and procedures followed were as described in Example 8 except that gaseous dimethylamine was recirculated over and through the adsorbents under atmospheric pressure of air for about 20 hours. As set forth in FIG. 6, the AP—MgO adsorbed more dimethylamine than the activated carbon samples. Pelletized AP—MgO will achieve substantially the same results as the powder AP—MgO.

#### EXAMPLE 10

An experiment was conducted to determine the ability of powder AP—MgO to adsorb ammonia compared with the ability of activated carbon to adsorb ammonia. The molar ratio of adsorbent to ammonia was 10:1. The adsorption conditions and procedures followed were as described in Example 8 except that gaseous ammonia was recirculated over and through the adsorbents for about 20 hours both under air and in the absence of air. As set forth in FIG. 7, the AP—MgO adsorbed more ammonia than the activated carbon samples. While the ammonia was adsorbed in lesser amounts than the aldehydes, it was adsorbed at a rapid rate. Pelletized AP—MgO will achieve substantially the same results as the powder AP—MgO.

#### EXAMPLE 11

An experiment was conducted to determine the ability of powder AP—MgO to adsorb methanol as compared to the ability of activated carbon to adsorb methanol. The molar ratio of adsorbent to methanol was 10:1. The adsorption conditions and procedures followed were as described in Example 8 except that gaseous methanol was recirculated over and through the adsorbents for about 20 hours under air. As set forth in FIG. 8, the AP—MgO adsorbed substantially more methanol than the activated carbon samples adsorbed. While the methanol was adsorbed in lesser amounts than the aldehydes, it was adsorbed at a rapid rate. Pelletized AP—MgO will achieve substantially the same results as the powder AP—MgO.

#### EXAMPLE 12

##### Production of Pellet Using a Disk Granulator

The metal hydroxide powder is granulated in a Colton Model 561 Rotary Wet Granulator to generate spherical particles of about 10 mm in diameter. These particles are

granulated through an addition of small amounts of water. The minimum amount of water is used to start the growth of granules.

Granules of the hydroxide after some drying in air or inert atmosphere are activated to oxides, which regenerates the high surface area. This is accomplished by heating the  $\text{Mg}(\text{OH})_2$  under dynamic vacuum ( $10^{-2}$  Torr) conditions at an ascending temperature rate to a maximum temperature of  $500^\circ\text{C}$ . which is held for 6 hrs.

#### EXAMPLE 13

##### Production of Metal Oxide Powder-Enhanced HEPA Filter Using Spray Granulation

A mark 20 HEPA from Natural Solutions is impregnated using high surface area metal oxides. Metal oxides can be applied to the filter substrate by spraying metal oxide or hydroxide mixed with water, or other solvent. In this technique, water or solvent droplets adhere to the filter substrate, forming a porous layer of powder bound to the filter. In case water is used and there is significant conversion from oxide to hydroxide, the filter has to be activated. Processing under vacuum to reactivate the oxide may be used.

We claim:

1. A composite comprising a self-sustaining body formed of a plurality of agglomerated nanocrystalline particles having an average crystallite size of up to about 20 nm and selected from the group consisting of metal oxides and hydroxides and mixtures thereof, said body having a total pore volume which is at least about 90% of the total pore volume of said particles prior to said agglomeration thereof, said body having a density of from about 0.2 to about  $2.0\text{ g/cm}^3$ .

2. The composite of claim 1, said particles being selected from the group consisting of  $\text{MgO}$ ,  $\text{CaO}$ ,  $\text{TiO}_2$ ,  $\text{ZrO}_2$ ,  $\text{FeO}$ ,  $\text{V}_2\text{O}_5$ ,  $\text{V}_2\text{O}_3$ ,  $\text{Mn}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{NiO}$ ,  $\text{CuO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{ZnO}$ ,  $\text{Mg}(\text{OH})_2$ ,  $\text{Ca}(\text{OH})_2$ ,  $\text{FeO}(\text{OH})$ ,  $\text{Ni}(\text{OH})_2$ ,  $\text{Cu}(\text{OH})_2$ ,  $\text{Al}(\text{OH})_3$ ,  $\text{Zn}(\text{OH})_2$ , and mixtures thereof.

3. The composite of claim 2, said particles being  $\text{MgO}$ .

4. The composite of claim 2, said particles being  $\text{CaO}$ .

5. The composite of claim 1, said body formed by pressing together said particles at a pressure of from about 50 psi to about 6,000 psi.

6. The composite of claim 5, said particles being pressed at a pressure of from about 1,000 psi to about 5,000 psi.

7. The composite of claim 6, said particles being pressed at a pressure of 2,000 psi.

8. The composite of claim 1, said particles being pressed-together.

9. A method of adsorbing a target compound comprising the steps of:

providing a quantity of the composite of claim 1; and

contacting said composite with a target compound selected from the group consisting of acids, alcohols, aldehydes, compounds containing an atom of P, S, N, Se, or Te, hydrocarbon compounds, and toxic metal compounds under conditions for adsorbing at least a portion of said target compound.

10. The method of claim 9, said particles being selected from the group consisting of  $\text{MgO}$ ,  $\text{CaO}$ ,  $\text{TiO}_2$ ,  $\text{ZrO}_2$ ,  $\text{FeO}$ ,  $\text{V}_2\text{O}_5$ ,  $\text{V}_2\text{O}_3$ ,  $\text{Mn}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{NiO}$ ,  $\text{CuO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{ZnO}$ ,  $\text{Mg}(\text{OH})_2$ ,  $\text{Ca}(\text{OH})_2$ ,  $\text{FeO}(\text{OH})$ ,  $\text{Ni}(\text{OH})_2$ ,  $\text{Cu}(\text{OH})_2$ ,  $\text{Al}(\text{OH})_3$ ,  $\text{Zn}(\text{OH})_2$ , and mixtures thereof.

11. The method of claim 10, said particles being  $\text{MgO}$ .

12. The method of claim 10, said particles being  $\text{CaO}$ .

13. The method of claim 9, said target compound being in

the form of a gas.

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14. A method of removing an acid from a gas stream comprising the steps of:  
providing a quantity of self-sustaining bodies formed of agglomerated, nanocrystalline  
metal oxide particles selected from the group consisting of CaO and Ca(OH)<sub>2</sub> and  
admixtures thereof, the starting particles having an average crystallite size of up to  
about 20 nm; and  
passing a stream of acid-bearing gas into contact with said self-sustaining bodies under  
conditions for removing at least a portion of said acid from the gas stream.

15. The method of claim 14, wherein said acid contains a sulfur atom.

16. The method of claim 14, said particles in the form of compressed-together  
bodies produced by pressing together said particles at a pressure of from about 50 psi to about  
6,000 psi.

17. The method of claim 14, said bodies formed by pressing together said  
particles at a pressure of from about 500 psi to about 5,000 psi.

18. The method of claim 14, said bodies having a density of from about 0.2 to  
about 2.0 g/cm<sup>3</sup>.

19. The method of claim 14, said particles being CaO.

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